

WHAT IS CLAIMED IS:

1 1. Apparatus for incremental printing of an image; said
2 apparatus comprising:
3 means for addressing a region of the image at less
4 than full (100%) coverage;
5 means for adding further colorant quanta to selected
6 pixels already receiving said colorant as part of the
7 less-than-full coverage within the region;
8 whereby, within the region, the amount of the colo-
9 rant printed in some pixels is zero, in others is a first
10 nonzero number of colorant quanta, and in still others is
11 a second nonzero number of colorant quanta;
12 *second?* wherein the *second* ^{second} nonzero number is different from
13 the *first* nonzero number; and
14 means for printing the image including the region
15 with the added further quanta.

1 2. The apparatus of claim 1, wherein the adding means
2 further comprise:
3 means for establishing a ratio of number of added-
4 colorant pixels to total number of addressed pixels; and
5 means for setting the ratio to a value below one-
6 half.

0.15 (line 10-16)

1 3. The apparatus of claim 2, wherein:
2 the setting means comprise means for setting the
3 ratio to a value between 0.15 and 0.4 inclusive.

1 4. The apparatus of claim 3, wherein:

2 0 the setting means comprise means for accepting a hu-
3 man operator manual selection to trade off banding robust-
4 ness against granularity.

1 5. The apparatus of claim 4, wherein:

2 0 the accepting means comprise means for expressly pre-
3 senting to the operator some indicia of the tradeoff.

1 6. The apparatus of claim 5, wherein the indicating means
2 0 comprise a human-readable scale that indicates:

3
4 increasing banding robustness in one direc-
5 tion, and

6
7 decreasing granularity in an opposite
8 direction

9
10 or equivalent.

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1 7. A method for reducing band effects in incremental
2 printing of an image; said method comprising the steps of:
3 printing a region of the image at less than full
4 (100%) coverage; and
5 in order to compensate for colorant-placement error,
6 adding further colorant quanta to selected pixels already
7 receiving colorant as part of the less-than-full coverage
8 within the region;
9 whereby, within the region, the amount of colorant
10 printed in some pixels is zero, in others is a first
11 nonzero number of colorant quanta, and in still others is
12 a second nonzero number of colorant quanta;
13 wherein the second nonzero number is different from
14 the first nonzero number.

1 8. The method of claim 7, wherein:
2 said full coverage is approximately one colorant
3 quantum per printer pixel, on-average.

1 9. The method of claim 8, wherein: *Fig 2a.*
2 each colorant quantum forms in the printed image a
3 roughly circular dot of diameter approximately equal to
4 the length of a diagonal across a single printer pixel.

1 10. The method of claim 7, wherein: *cl 2, l 52-63*
2 said full coverage is approximately one-half colorant
3 quantum per printer pixel, on-average.

1 11. The method of claim 10, wherein:

2 each colorant quantum forms in the printed image a
3 roughly circular dot of diameter substantially equal to
4 twice the height or twice the width of a single printer
5 pixel.

1 12. The method of claim 7, wherein:

2 said full coverage is between one-half and one col-
3 orant quanta per printer pixel, on-average. ?

1 13. The method of claim 12, wherein:

2 each colorant quantum forms in the printed image a
3 roughly circular dot of diameter between one-half and one
4 times the height or between one-half and one times the
5 width of a single printer pixel. 7

1 14. The method of claim 7, further comprising the steps
2 of:

3 in another region of the image, printing an area fill
4 at less than double (200%) coverage; and ✓

5 within said other region, adding further colorant to
6 selected pixels already receiving colorant as part of the
7 area fill.

1 15. The method of claim 14, wherein:

2 said double coverage is approximately two colorant
3 quanta per printer pixel, on-average.

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1 16. The method of claim 15, wherein:

2 each colorant quantum forms in the printed image a
3 roughly circular dot of diameter approximately equal to
4 the length of a diagonal across a single printer pixel.

1 17. The method of claim 14, wherein:

2 said double coverage is approximately one colorant
3 quanta per printer pixel, on-average.

1 18. The method of claim 17, wherein:

2 each colorant quantum forms in the printed image a
3 roughly circular dot of diameter substantially equal to
4 twice the height or twice the width of a single printer
5 pixel.

1 19. The method of claim 14, wherein:

2 said double coverage is between one and two colorant
3 quanta per printer pixel, on-average.

1 20. The method of claim 19, wherein:

2 each colorant quantum forms in the printed image a
3 roughly circular dot of diameter between one and two times
4 the height or between one and two times the width of a
5 single printer pixel.

1 21. The method of claim 7, further comprising the step
2 of:

3 at least approximately maintaining a particular ratio
4 between said still other pixels and said pixels receiving
5 colorant as part of the less-than-full coverage within the
6 region.

1 22. A method of adding colorant in a region to which col-
2 orant is already addressed, in incremental printing of an
3 image; said method comprising the steps of:

4 automatically establishing a ratio of number of ad-
5 ded-colorant pixels to total number of addressed pixels;
6 setting the ratio to a value below one-half; and
7 automatically printing a region of the image with
8 said added-colorant pixels included at said ratio.

1 23. The method of claim 10, wherein:

2 the setting step comprises setting the ratio to a
3 value between 0.15 and 0.4 inclusive.

1 24. The method of claim 11, wherein:

2 the setting step comprises a human operator selection
3 to trade off banding robustness against granularity.

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1 25. The method of claim 12, wherein:
2 the setting step comprises a human operator selection
3 on a scale that expressly indicates:
4
5 increasing banding robustness in one direc-
6 tion, and
7
8 decreasing granularity in an opposite
9 direction,
10
11 or equivalent.

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1 26. The method of claim 10, wherein:
2 the setting step comprises a human operator selection
3 on a scale that expressly indicates:
4
5 increasing banding robustness in one direc-
6 tion, and
7
8 decreasing granularity in an opposite
9 direction
10
11 or equivalent.

1 27. A method of adding colorant in a region to which col-
2 orant is already addressed, in incremental printing of an
3 image; said method comprising the steps of:

4 automatically adding colorant by employing a super-
5 pixel that is very insensitive to characteristics of dot
6 placement error; and

7 automatically printing a region of the image with
8 said added colorant.

1 28. The method of claim 27, wherein:

2 the superpixel is intermediate in characteristics
3 between:

4 $[1 \ 0; \ 0 \ 1],$

5
6 $[2 \ 0; \ 0 \ 0].$

1 29. The method of claim 27, wherein the superpixel is
2 selected from the group consisting of:

3
4 $[2 \ 0; \ 0 \ 2],$

5
6 $[1 \ 0; \ 1 \ 0],$

7
8 $[1 \ 1; \ 0 \ 0],$

9
10 $[0 \ 0; \ 1 \ 1],$

11
12 $[0 \ 1; \ 0 \ 1].$

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1 30. A method of incremental printing of an image by con-
2 struction from individual colorant quanta addressed to
3 pixels of a printing grid; said method comprising the
4 steps of:

5 for substantially all tonal levels in a range extend-
6 ing at least from highlight regions to midtones:

7
8 automatically addressing a first number of col-
9 orant quanta to some pixels; and

10
11 automatically addressing a second number of
12 colorant quanta to other pixels, said sec-
13 ond number being larger than said first
14 number; and

15
16 automatically printing a region of the image with
17 said added colorant.

1 31. The method of claim 30, wherein:
2 said range extends at least from ten percent area
3 fill through forty percent area fill.

1 32. The method of claim 30, wherein:
2 said other pixels are selected substantially at
3 random from among said some pixels.